A ROLE-SPECIFIC NURSE SCHEDULING SYSTEM

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Abstract - **This study proposed a system to schedule the nursing practices. The schedule was arranged basing on the statuses of each patient and nurse. There was an alarm system for supervising the whole nursing progress, and it would raise a warning if any abnormal condition happened. The deployed work log database was for recording the full nursing procedures, and analyzing the outcome for schedule modification. The proposed system omitted the traditional paper work, and increased the efficiency and quality. It was useful in audit and administration, and it was also a valuable reference in the developments of nursing standard, clinic path, and electronic medical record.**

Keyword - **Nurse schedule, nursing standard, quality assurance**

I. INTRODUCTION

Clinical nursing practice is a job, which must face to patient directly. Its outcome deeply affects the care quality. In the modern nursing care, the nursing practices are usually in cooperation. As a result, the patient information sharing is very important for coordination [1-2]. Traditionally, senior professionals regularly arrange all the nursing schedules. It's very difficult to share the patient information in time, which causes obstruction in collaboration. Furthermore, it's also very hard to trace the nursing progress, and to confirm whether all the necessary procedures are done. Patient status is dynamically changing and some emergencies may happen time by time. However, as general people, the conditions of nurses are different in each other. Likewise, the strength, mentality, spirit and ability to a nurse as well are varied. Therefore, the nurse loading is altering from day to day. Artificial nurse scheduling cannot take the above factors into account [3], and causes the variation and poor quality in nursing care [4]. In this research, a nurse scheduling system was proposed. The system developed the guidelines for scheduling the nursing practices by the statuses of patients and nurses, and dynamically modified the schedule according with the condition changing of both the patients and nurses.

II. METHODOLOGY

The participation of nurses is valuable and indispensable for the system development, whether in providing recommends in the designing phase, or in supporting test in prototype phase. Their contributions improved the system operation to correspond their behavior model, and to increase the system acceptance [5].

All computers deployed in the system all were personal computers. The graphic operation system, MS-WINDOWS 2000, was adopted for their friendliness and generalization. The database engine was MS SQL 7.0, and the query language was Consequent SQL. All the system software and hardware were vender-independent that resulted in the system flexibility and scalability.

The system structure was shown in Fig. 1. It included an order reference database, a loading reference database, a patient database, a manpower database, a terminological database, a work log database, and an alarm system. The order reference database offered the related nursing practices corresponded to the order. The loading reference database defined the loading for each nursing practice by its different content and quality. The patient database recorded the patient information. The manpower database recorded the nursing manpower resources. The terminological database offered medical terminology; it simplified the entry and avoided mistake. The work log database recorded the progresses for each nursing practice. The alarm system supervised the whole system operation, ranged over nursing practice delay, manpower conflict, and order mismatch.

Every time when an order was placed, the system would refer the patient database firstly for making sure the order and patient conditions were consistent. If there was any conflict, the system raised an alarm. Next the examined order was driven into order reference database to arrange the corresponding nursing practices. Then all nursing practices would be analyzed with cross-referring the patient database, loading reference database, and manpower database for inspecting any collision. The alarm system monitored the whole progress, and gave an alarm for any inappropriate condition. Finally, the full schedule was completed. The scheduling flowchart was shown in Fig. 2. During the nursing progress, the work log database recorded each nursing
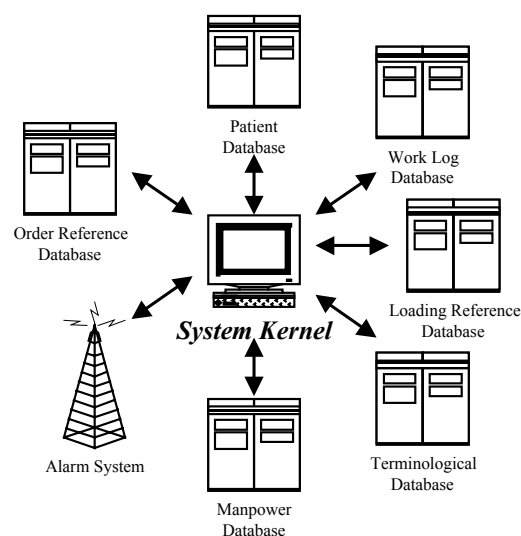

Fig. 1. System structure

Report Documentation Page

Report Date	Report Type	Dates Covered (from... to)
25 Oct 2001	N/A	-

Title and Subtitle A Role-Specific Nurse Scheduling System	**Contract Number**
	Grant Number
	Program Element Number
Author(s)	**Project Number**
	Task Number
	Work Unit Number
Performing Organization Name(s) and Address(es) Department of Nursing Chang-Gung Institute of Nursing Taiwan	**Performing Organization Report Number**
Sponsoring/Monitoring Agency Name(s) and Address(es) US Army Research, Development & Standardization Group (UK) PSC 802 Box 15 FPO AE 09499-1500	**Sponsor/Monitor's Acronym(s)**
	Sponsor/Monitor's Report Number(s)

Distribution/Availability Statement
Approved for public release, distribution unlimited

Supplementary Notes
Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Abstract

Subject Terms

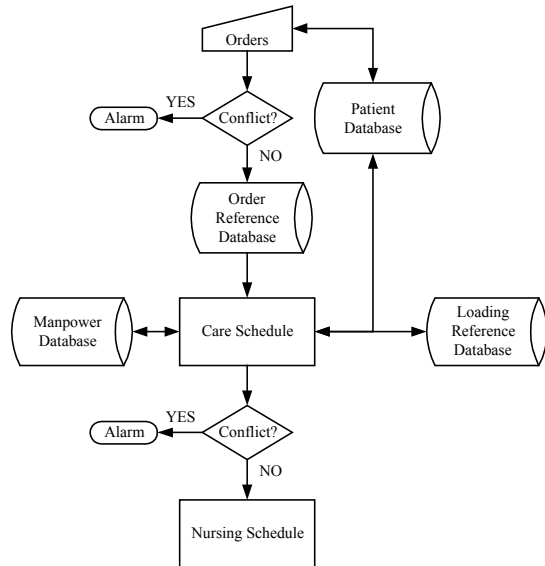|	
Report Classification unclassified	**Classification of this page** unclassified
Classification of Abstract unclassified	**Limitation of Abstract** UU

Number of Pages
3

Fig. 2. Scheduling flowchart

practice, afterward analyzed and induced the necessary information for updating the patient database, loading database, and manpower database in order to modify the next schedule with the latest conditions.

A ward was prepared for performance comparison, which included 6 doctors, 11 nurses, and 40 patients. The conditions of the ward would be led to the proposed system, and process the automatic scheduling. The result would be compared with the current artificial scheduling of that ward.

III. RESULT

The prototype system was implemented and its design had been proven to be beneficial to nurses. The end users involved themselves during the whole development progress, and led to the high friendly graphic user interface, which embodied their behavior model and effectively shortened the learning course. A frame for routine schedule was shown in Fig. 3. The left-upper window was for schedule presentation and entry, and a box tailed after each job for checking. The left-lower window showed the patient orders and corresponding nursing practices. Each schedule was selected through a drop-down listing located at right-upper area. Below that there was a patient list. When a patient was selected, the corresponding records would display in the left-lower window. Two other listings located on right lower area, which were for nursing practices addition or deletion, and administration.

The proposed system scheduled the nursing practices depend on the statuses of patients and nurses, and traced the whole nursing progress for loading analysis, and provided suggestions for schedule modification. The alarm system supervised the execution for each nursing practice. It warned when any inappropriate condition happened. Subsequently, it could ensure every nursing practice was executed exactly, impeded the inappropriate orders, and manpower mismanagement. All the arrangements effectively eased the care cooperation, reduced the care variation and advanced the care quality. In the performance comparison with the current artificial scheduling, the proposed system found that 3 improper orders, 7 delay jobs, and 2 omission procedures happened before next nursing shift.

Additionally, The proposed system saved lots of time in reducing traditional paper work. The system offered structured checklist for shift, which contained the accomplished jobs, unfinished jobs, and specific notes. The time consuming wordy verbalism and note writing were dispelled. Then the shift procedure resulted in more efficiency and precision. The nursing record writing is usually cumbersome, which always spends lots of time. The incomplete and illegible are the general case. The proposed system generated the nursing record automatically, which was directly dumped from work log database. The auto-generated record was detailed, legible, and clear.

IV. DISCUSSION

The proposed system supervised the whole nursing progress and registered each procedure. The detailed and complete information could be used for analyzing the outcome of execution, and provide a global aspect for administration and audit. This study investigated the guidelines to schedule the nursing practices in a reasonable and appropriate method. The guidelines as well were the valuable references for developing nursing standards. Additionally, the nursing is an important part of clinic path. The proposed system would promote the clinic path development, and increase care quality assurance. The implementation of electronic medical record includes the computerization in each hospital department. The proposed system made the nursing schedule computerized, and would promote the complete nursing record in full electronic. As a result the system was a significant part in the implementation of electronic medical record.

In this study, the nurse should take a brief and make notes when visiting the patient. Sometimes the nurse must go back to the station for information reviewing. The Personal Digital Assistant (PDA) can ease the information access, and improve the mobility. Including the PDA in the current study is under consideration.

Fig. 3. Graphic User Interface

V. Conclusion

This research proposed a system to dynamically schedule the nursing practices basing on the roles of patient and nurse. It omitted the traditional paper work, and increased the nursing efficiency and quality. It was useful in audit and administration, and was also as a valuable reference in developments of nursing standard, clinic path, and electronic medical record.

References

[1] M. F. Collen, "A vision of health care and informatics in 2008," *J. Am. Med. Inform. Assoc.*, vol. 6, pp. 1-5, Jan/Feb 1999.

[2] N. M. Lorenzi, and R. T. Riley, "Managing change: an overview," *J. Am. Med. Inform. Assoc.*, vol. 7, pp. 116-124, May/Apr 2000.

[3] J. S. Zolot, "Computer-based patient records," *Am. J. Nurs.*, vol. 99, pp. 65-69, 1999.

[4] T. J. Hannan, "Variation in health care   the roles of the electronic medical record," *Int. J. Med. Inform.*, vol. 54, pp. 127-136, 1999.

[5] C. J. McDonald, "The barriers to electronic medical record systems and how to overcome them," *J. Am. Med. Inform. Assoc.*, vol. 4, pp. 213-221, May/Jun 1997.